REMARKS

The Office Action dated April 6, 2005 has been carefully reviewed and the foregoing amendment and following remarks have been made in consequence thereof.

Claims 1-26 are pending in this application. Claims 1-26 stand rejected.

The objection to Claim 26 is respectfully traversed. Claim 26 has been amended to recite "reconstruct an error image using the error-candidate projection," thereby giving antecedent basis to "the error image" in lines 2-3. Accordingly, Applicant respectfully requests the objection to Claim 26 be withdrawn.

The rejection of Claims 3, 6, 15, 18, 24, and 26 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1 and 3 of Toth, (U.S. Patent No. 6,115,487) in view of Snyder et al., (U.S. Patent No. 5,923,775) is respectfully traversed.

Applicant respectfully submits that Claims 3, 6, 15, 18, 24, and 26 of the present application have not been finalized because there has been no indication that these claims contain allowable subject matter. As such, Applicant submits that the obvious-type double patenting rejection is only a provisional rejection. Accordingly, Applicant respectfully requests that the obvious-type double patenting rejection of Claims 3, 6, 15, 18, 24, and 26 be withdrawn at this time.

The rejection of Claims 1, 2, 5, 7, 10-14, 17, and, 20-23 under 35 U.S.C. § 103(a) as being unpatentable over Mattson et al. (U.S. Patent No. 5,229,934) in view of Snyder et al. (U.S. Patent No. 5,078,605) is respectfully traversed.

Mattson et al. describe a CT scanner that includes a non-invasive examination means A for generating raw data concerning a patient or subject being examined. An image processing means B processes the generated raw data into an electronic image representation. A defective or bad data identifying means C examines the image representation and identifies the bad data responsible for any streaking or analogous artifacts. An image post processing or correction means D processes data from the image representation to reduce or eliminate the streaks and analogous artifacts. The bad data identifying means c may be activated by the

radiologist or technician upon noting an offensive streak or may review all images automatically to remove both readily apparent streaking and subtle artifacts. A threshold means 50 compares the magnitude of the gradient of each pixel value in the image memory with a preselected threshold. The threshold may be determined by trial and error to produce an optimal balance between the removal of streaks and the retention of an original image distinctiveness. Each pixel is assigned a one or a zero value depending on whether its gradient is above or below the threshold value and loaded into a gradient image memory means 52. A forward projecting means 54 is indexed by a ray number counter 56 to forward project a data set along each ray of the gradient image representation in the gradient image memory 52. A comparing means 60 compares each forward projected ray of the gradient image with a standard to determine whether the ray represents good or bad data. For example, the digital values of the gradient image ray may be summed, and the sum compared with a threshold value. The image correcting or post-processing means D includes a forward projector 90 which forward projects the image representation from the image memory means 46 along each of the rays identified as bad by the bad ray identifying means C. Notably, Mattson et al. do not describe estimating a gradient for at least one high-density object, rather Mattson et al. describe comparing the magnitude of the gradient of each pixel value in the image memory with a preselected threshold and assigning each pixel a one or a zero value depending on whether its gradient is above or below the threshold value. Mattson et al. also do not describe generating a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in z, but rather Mattson et al. describe that each pixel in the image memory is assigned a one or a zero value depending on whether its gradient is above or below the threshold value and loaded into a gradient image memory means 52. A forward projecting means 54 is indexed by a ray number counter 56 to forward project a data set along each ray of the gradient image representation in the gradient image memory 52. Moreover Mattson et al. do not describe generating an error-candidate projection using the gradient image.

Snyder et al. describes a system for estimating and reducing noise in images. A first stage of the system estimates the signal dependent noise in the image. A second stage reduces the signal dependent noise through image processing based on the estimates obtained from the first stage. The image is segmented into a plurality of new images. For each of the

images in the plurality of new images the corresponding pixels in a gradient image are examined. The gradient image represents the magnitude of the gradient at each point in the image, independent of direction. A histogram of gradient values is calculated for each image in the plurality of new image. These histograms are used to determine a gradient threshold point for each range of code values in the original image.

For pixels in the original image, if the said threshold criterion corresponding to that pixel's code value range is met, then an expected value is computed for that pixel. The difference between the expected and the actual code value is then calculated. For each code value range, the standard deviation of the difference between the expected and real difference is calculated. The standard deviation is used as the estimate of noise for that code value range.

For the second stage (noise reduction) a plurality of expected values are calculated for each pixel in the original image. A different neighborhood of pixels is used to generate each of the plurality of expected values. The difference between the actual pixel code value and each of the expected values is also calculated. A new estimate of the pixel's code value is derived by aggregating all of the plurality of expected values. Expected values with lower differences are weighted higher than those with higher differences and all estimates are adjusted by the signal dependent amount of noise estimated in the first stage. Thus, a new estimated code value is generated for each pixel in the original image. All of these new estimates, together, create a new noise reduce image.

Applicant respectfully submits that the Section 103 rejection of the presently pending claims is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. Neither Mattson et al. nor Snyder et al., considered alone or in combination, describe or suggest the claimed combination. Furthermore, in contrast to the assertion within the Office Action, Applicant respectfully submits that it would not be obvious to one skilled in the art to combine Mattson et al with Snyder et al., because there is no motivation to combine the references suggested in the art. Additionally, the Examiner has not pointed to any prior art that teaches or suggests to combine the disclosures, other than Applicant's own teaching. Rather, only the conclusory

statement that "[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to have used the techniques of Snyder et al. to produce the gradient images used in Mattson et al. to estimate and reduce the noise or artifacts in images" suggests combining the disclosures.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicants' disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck , 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion or motivation to combine the prior art disclosures, nor any reasonable expectation of success has been shown.

Furthermore, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. Further, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection appears to be based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention.

Moreover, if art "teaches away" from a claimed invention, such a teaching supports the nonobviousness of the invention. U.S. v. Adams, 148 USPQ 479 (1966); Gillette Co. v. S.C. Johnson & Son, Inc., 16 USPQ2d 1923, 1927 (Fed. Cir. 1990). In light of this standard, it is respectfully submitted that the cited, as a whole, is not suggestive of the presently claimed invention. Moreover, Applicant submits that Mattson et al. teach away from Snyder et al. and the present invention, and as such, there is no suggestion or motivation to combine Mattson et al. with Snyder et al.. Specifically, Mattson et al. describe correcting bad data in an image wherein bad data is described as being:

> ...caused by any one of these components going bad, a loose wiring connection, or even downstream components, such as channels of an analog-to-digital converter, going bad. The bad data could take the form of a constant zero output, an intermittent zero or high output, noise or static superimposed on otherwise good data....

Mattson et al., column 3, lines 48-54. Snyder et al. describe a technique that differentially estimates and removes noise as a signal-dependent function of image the image features. The present describes reducing artifacts caused by a rapid change of the anatomy in the z direction and an inability of a linear interpolation to produce accurate sample estimation. Therefore Mattson et al. and Snyder et al. correct data for machine borne electrical defects, while the present invention describes a different field of error correction due to anatomy borne artifacts. Moreover, the present invention describes a gradient image that represents the variation of a high density object, for example, a rib or spine, in the *z* direction at the reconstructed image location. Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Accordingly, for at least the reasons set forth above, Applicant respectfully requests that the Section 103 rejection be withdrawn.

Moreover, and to the extent understood, no combination of Mattson et al., or Snyder et al. describes or suggests the claimed combination and as such, the presently pending claims are patentably distinguishable from the cited combination. Specifically, Independent Claim 1 recites a method for facilitating reconstruction of an image wherein the method includes "estimating a gradient for at least one high-density object...generating a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*...generating an error-candidate projection using the gradient image."

Neither Mattson et al. nor Snyder et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests generating a gradient image using the estimated gradient wherein the gradient image represents a variation of the

high density object in *z*. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value, and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Furthermore, no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests generating an error-candidate projection using the gradient image. Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, and Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image. Accordingly, and for at least the reasons set forth above, Claim 1 is submitted as patentable over Mattson et al. in view of Snyder et al.

Claims 2, 5, 7, and 10-12 depend from independent Claim 1. When the recitations of Claims 2, 5, 7, and 10-12 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claims 2, 5, 7, and 10-12 likewise are patentable over Mattson et al. in view of Snyder et al.

Claim 13 recites a computer programmed to "estimate a gradient for at least one high-density object...generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*...generate an error-candidate projection using the gradient image."

Neither Mattson et al. nor Snyder et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computer programmed to generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value, and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Furthermore, no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computer programmed to generate an error-candidate projection using the gradient image.

Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, and Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image. Accordingly, and for at least the reasons set forth above, Claim 13 is submitted as patentable over Mattson et al. in view of Snyder et al.

Claims 14, 17, 20, and 21 depend from independent Claim 13. When the recitations of Claims 14, 17, 20, and 21 are considered in combination with the recitations of Claim 13, Applicants respectfully submit that Claims 14, 17, 20, and 21 likewise are patentable over Mattson et al. in view of Snyder et al.

Claim 22 recites a computed tomographic (CT) imaging system for reconstructing an image of an object wherein the imaging system includes "a detector array...at least one radiation source...a computer coupled to said detector array and said radiation source, said computer configured to...estimate a gradient for at least one high-density object...generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*...generate an error-candidate projection using the gradient image."

Neither Mattson et al. nor Snyder et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computed tomographic (CT) imaging system having a computer configured to generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value, and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Furthermore, no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computed tomographic (CT) imaging system having a computer configured to generate an error-candidate projection using the gradient image. Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting

and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, and Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image. Accordingly, and for at least the reasons set forth above, Claim 22 is submitted as patentable over Mattson et al. in view of Snyder et al.

Claim 23 depends from independent Claim 22. When the recitations of Claim 23 are considered in combination with the recitations of Claim 22, Applicants respectfully submit that Claim 23 likewise is patentable over Mattson et al. in view of Snyder et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 1, 2, 5, 7, 10-14, 17, and, 20-23 be withdrawn.

The rejection of Claims 3, 6, 8, 15, 24, and 26 under 35 U.S.C. § 103(a) as being unpatentable over Mattson et al. (U.S. Patent No. 5,229,934) in view of Snyder et al. (U.S. Patent No. 5,078,605) and further in view of Toth (U.S. Patent No. 6,115,487) is respectfully traversed.

Mattson et al. and Snyder et al. are described above. Toth et al. describe a spectral correction algorithm for correcting dense object-induced spectral artifacts. A calibration object and a water or water-equivalent cylinder are scanned and reconstructed. The ratio of the images of the calibration object and the water-equivalent cylinder is evaluated, and a region of interest extracted by multiplying the ratio by a function to obtain a calibration pattern CP. The calibration pattern is then averaged in azimuth to obtain a calibration vector. Low frequency components of the calibration vector are removed. A calibration error vector is obtained by subtracting 1.0 from the ratio, and multiplying by a CT number scale factor and an apodizing window. The calibration error vector CEV is representative of the circularly symmetric image error introduced by the non-corrected bone-induced artifact. The corresponding error calibration vector can be expanded into a circularly symmetric image error pattern and subtracted from the calibration image to provide a substantially artifact free image. The method can be extended to extract and correlate error vectors on an image segment basis such that the resulting error image pattern is not circularly symmetric.

Applicant respectfully submits that the Section 103 rejection of the presently pending claims is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. None of Mattson et al., Snyder et al., or Toth et al., considered alone or in combination, describe or suggest the claimed combination. Furthermore, in contrast to the assertion within the Office Action, Applicant respectfully submits that it would not be obvious to one skilled in the art to combine Mattson et al with Snyder et al. and Toth et al., because there is no motivation to combine the references suggested in the art. Additionally, the Examiner has not pointed to any prior art that teaches or suggests to combine the disclosures, other than Applicant's own teaching. Rather, only the conclusory statement that "[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to have scaled or weighted the error image of Mattson et al. with the method of Toth et al. in order to improve the error correction process." suggests combining the disclosures.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicants' disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck , 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion or motivation to combine the prior art disclosures, nor any reasonable expectation of success has been shown.

Furthermore, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. Further, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection appears to be based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention.

Moreover, if art "teaches away" from a claimed invention, such a teaching supports the nonobviousness of the invention. U.S. v. Adams, 148 USPQ 479 (1966); Gillette Co. v. S.C. Johnson & Son, Inc., 16 USPQ2d 1923, 1927 (Fed. Cir. 1990). In light of this standard, it is respectfully submitted that the cited, as a whole, is not suggestive of the presently claimed invention. Moreover, Applicant submits that Mattson et al. teach away from Snyder et al., Toth et al., and the present invention, and as such, there is no suggestion or motivation to combine Mattson et al. with Snyder et al.. Specifically, Mattson et al. describe correcting bad data in an image wherein bad data is described as being:

> ...caused by any one of these components going bad, a loose wiring connection, or even downstream components, such as channels of an analog-to-digital converter, going bad. The bad data could take the form of a constant zero output, an intermittent zero or high output, noise or static superimposed on otherwise good data....

Mattson et al., column 3, lines 48-54. Snyder et al. describe a technique that differentially estimates and removes noise as a signal-dependent function of image the image features. The present describes reducing artifacts caused by a rapid change of the anatomy in the z direction and an inability of a linear interpolation to produce accurate sample estimation. Toth describes a correction algorithm for correcting dense object induced spectral artifacts. Therefore Mattson et al. and Snyder et al. correct data for machine borne electrical defects, while Toth et al. and the present invention describe a different field of error correction due to anatomy borne artifacts. Moreover, the present invention describes a gradient image that represents the variation of a high density object, for example, a rib or spine, in the *z* direction at the reconstructed image location. Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction and Toth et al. describe obtaining a calibration error vector (CEV) that is representative of the circularly symmetric image error, but none of Mattson et al., Snyder et al., or Toth et al. describe an error candidate projection. Accordingly, for at least the reasons set forth above, Applicant respectfully requests that the Section 103 rejection be withdrawn.

Moreover, and to the extent understood, no combination of Mattson et al., or Snyder et al., or Toth et al. describes or suggests the claimed combination and as such, the presently pending claims are patentably distinguishable from the cited combination. Specifically, Independent Claim 1 recites a method for facilitating reconstruction of an image wherein the method includes "estimating a gradient for at least one high-density object...generating a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*...generating an error-candidate projection using the gradient image."

None of Mattson et al., Snyder et al., or Toth et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests generating a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value, Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction, and Toth et al. describe a spectral correction algorithm using a ratio of an image of a calibration object and a water or water-equivalent cylinder to obtain a calibration vector. Furthermore, no combination of Mattson et al., or Snyder et al., or Toth et al., alone or in combination, describes or suggests generating an error-candidate projection using the gradient image. Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image, and Toth et al. describe obtaining a calibration error vector (CEV) that is representative of the circularly symmetric image error, but none of Mattson et al., Snyder et al., or Toth et al. describe an error candidate projection.. Accordingly, and for at least the reasons set forth above, Claim 1 is submitted as patentable over Mattson et al. in view of Snyder et al and further in view of Toth et al.

Claims 6 and 8 depend from independent Claim 1. When the recitations of Claims 6 and 8 are considered in combination with the recitations of Claim 1, Applicants respectfully

submit that Claims 6 and 8 likewise are patentable over Mattson et al. in view of Snyder et al. and further in view of Toth et al.

Claim 13 recites a computer programmed to "estimate a gradient for at least one high-density object...generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*...generate an error-candidate projection using the gradient image."

None of Mattson et al., Snyder et al., or Toth et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computer programmed to generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value, and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Furthermore, no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computer programmed to generate an error-candidate projection using the gradient image. Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, and Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image and Toth et al. describe obtaining a calibration error vector (CEV) that is representative of the circularly symmetric image error, but none of Mattson et al., Snyder et al., or Toth et al. describe an error candidate projection. Accordingly, and for at least the reasons set forth above, Claim 13 is submitted as patentable over Mattson et al. in view of Snyder et al. and further in view of Toth et al.

Claims 15 and 18 depend from independent Claim 13. When the recitations of Claims 15 and 18 are considered in combination with the recitations of Claim 13, Applicants respectfully submit that Claims 15 and 18 likewise are patentable over Mattson et al. in view of Snyder et al. and further in view of Toth et al.

Claim 22 recites a computed tomographic (CT) imaging system for reconstructing an image of an object wherein the imaging system includes "a detector array...at least one radiation source...a computer coupled to said detector array and said radiation source, said computer configured to...estimate a gradient for at least one high-density object...generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in z...generate an error-candidate projection using the gradient image."

None of Mattson et al., Snyder et al., or Toth et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computed tomographic (CT) imaging system having a computer configured to generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in z. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value, and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Furthermore, no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computed tomographic (CT) imaging system having a computer configured to generate an error-candidate projection using the gradient image. Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, and Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image and, and Toth et al. describe a spectral correction algorithm using a ratio of an image of a calibration object and a water or water-equivalent cylinder to obtain a calibration vector, but none of Mattson et al., Snyder et al., or Toth et al. describe an error candidate projection. Accordingly, and for at least the reasons set forth above, Claim 22 is submitted as patentable over Mattson et al. in view of Snyder et al. and further in view of Toth et al.

Claims 24 and 26 depend from independent Claim 22. When the recitations of Claims 24 and 26 are considered in combination with the recitations of Claim 22, Applicants

respectfully submit that Claims 24 and 26 likewise are patentable over Mattson et al. in view of Snyder et al. and further in view of Toth et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 3, 6, 8, 15, 24, and 26 be withdrawn.

The rejection of Claims 4, 16, and 25 under 35 U.S.C. § 103(a) as being unpatentable over Mattson et al. (U.S. Patent No. 5,229,934) in view of Snyder et al. (U.S. Patent No. 5,078,605) and further in view of Toth (U.S. Patent No. 6,115,487) and further in view of Florent et al. (U.S. Patent No. 5,594,845) is respectfully traversed.

Mattson et al. and Snyder et al., and Toth et al. are described above. Florent et al. describe a method of processing a digital image to construct a calculated target image, which represents a source image reconstructed with modifications to the tilting angle, panning angle and scale factor using an algorithm with functions required to implement "perspective transformations" stored on memory cards in look-up tables.

Applicant respectfully submits that the Section 103 rejection of the presently pending claims is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. None of Mattson et al., Snyder et al., Toth et al., or Florent et al., considered alone or in combination, describe or suggest the claimed combination. Furthermore, in contrast to the assertion within the Office Action, Applicant respectfully submits that it would not be obvious to one skilled in the art to combine Mattson et al with Snyder et al., Toth et al., and Florent et al. because there is no motivation to combine the references suggested in the art. Additionally, the Examiner has not pointed to any prior art that teaches or suggests to combine the disclosures, other than Applicant's own teaching. Rather, only the conclusory statement that "[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to use the scaling scheme from Florent et al. in the scaling method of Toth et al. in order to reduce the complexity of the image processing method" suggests combining the disclosures. However, Toth et al. use a "CT number scale factor" that is a scale factor normalizing CT numbers to the attenuation of water, which has a scaled CT number of 1000 and Florent et al. describe using a scale factor to geometrically relate a source image and a target image. Applicants

respectfully submit that using the scaling methodology of Florent et al. is not applicable to the use of scaling by Toth et al., accordingly Applicant respectfully submits that it would not be obvious to one skilled in the art to combine Mattson et al with Snyder et al., Toth et al., and Florent et al. because of the widely different uses of "scaling" in the cited art.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicants' disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck , 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion or motivation to combine the prior art disclosures, nor any reasonable expectation of success has been shown.

Furthermore, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. Further, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection appears to be based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention.

Moreover, if art "teaches away" from a claimed invention, such a teaching supports the nonobviousness of the invention. U.S. v. Adams, 148 USPQ 479 (1966); Gillette Co. v. S.C. Johnson & Son, Inc., 16 USPQ2d 1923, 1927 (Fed. Cir. 1990). In light of this standard, it is respectfully submitted that the cited, as a whole, is not suggestive of the presently claimed invention. Moreover, Applicant submits that Mattson et al. teach away from Snyder et al., Toth et al., and the present invention, and as such, there is no suggestion or motivation to combine Mattson et al. with Snyder et al.. Specifically, Mattson et al. describe correcting bad data in an image wherein bad data is described as being:

> ...caused by any one of these components going bad, a loose wiring connection, or even downstream components, such as channels of an analog-to-digital converter, going bad. The bad data could take the form of a constant zero output, an intermittent zero or high output, noise or static superimposed on otherwise good data....

Mattson et al., column 3, lines 48-54. Snyder et al. describe a technique that differentially estimates and removes noise as a signal-dependent function of image the image features. The present describes reducing artifacts caused by a rapid change of the anatomy in the z direction and an inability of a linear interpolation to produce accurate sample estimation. Toth describes a correction algorithm for correcting dense object induced spectral artifacts and Florent et al. describe using a scale factor to geometrically relate a source image and a target image. Therefore Mattson et al. and Snyder et al. correct data for machine borne electrical defects, while Toth et al. and the present invention describe a different field of error correction due to anatomy borne artifacts. Moreover, the present invention describes a gradient image that represents the variation of a high density object, for example, a rib or spine, in the *z* direction at the reconstructed image location. Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction and Toth et al. describe obtaining a calibration error vector (CEV) that is representative of the circularly symmetric image error, but none of Mattson et al., Snyder et al., Toth et al., or Florent et al. describe an error candidate projection. Accordingly, for at least the reasons set forth above, Applicant respectfully requests that the Section 103 rejection be withdrawn.

Moreover, and to the extent understood, no combination of Mattson et al., Snyder et al., Toth et al., or Florent et al. describes or suggests the claimed combination and as such, the presently pending claims are patentably distinguishable from the cited combination. Specifically, Independent Claim 1 recites a method for facilitating reconstruction of an image wherein the method includes "estimating a gradient for at least one high-density object...generating a gradient image using the estimated gradient wherein the gradient image

represents a variation of the high density object in *z*...generating an error-candidate projection using the gradient image."

None of Mattson et al., Snyder et al., Toth et al., or Florent et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests generating a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value, and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Furthermore, no combination of Mattson et al., or Snyder et al., Toth et al., or Florent et al., alone or in combination, describes or suggests generating an error-candidate projection using the gradient image. Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image, Toth et al. describe obtaining a calibration error vector (CEV) that is representative of the circularly symmetric image error, and Florent et al. describe using a scale factor to geometrically relate a source image and a target image., but none of Mattson et al., Snyder et al., Toth et al., or Florent et al. describe an error candidate projection.. Accordingly, and for at least the reasons set forth above, Claim 1 is submitted as patentable over Mattson et al. in view of Snyder et al and further in view of Toth et al. and further in view of Florent et al.

Claim 4 depends from independent Claim 1. When the recitations of Claim 4 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claim 4 likewise is patentable over Mattson et al. in view of Snyder et al. and further in view of Toth et al. and further in view of Florent et al.

Claim 13 recites a computer programmed to "estimate a gradient for at least one high-density object...generate a gradient image using the estimated gradient wherein the gradient

image represents a variation of the high density object in *z*...generate an error-candidate projection using the gradient image."

None of Mattson et al., Snyder et al., Toth et al., or Florent et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computer programmed to generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value, and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Furthermore, no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computer programmed to generate an error-candidate projection using the gradient image. Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, and Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image Toth et al. describe obtaining a calibration error vector (CEV) that is representative of the circularly symmetric image error, and Florent et al. describe using a scale factor to geometrically relate a source image and a target image, but none of Mattson et al., Snyder et al., Toth et al., or Florent et al. describe an error candidate projection. Accordingly, and for at least the reasons set forth above, Claim 13 is submitted as patentable over Mattson et al. in view of Snyder et al. and further in view of Toth et al. and further in view of Florent et al.

Claim 16 depends from independent Claim 13. When the recitations of Claim 16 are considered in combination with the recitations of Claim 13, Applicants respectfully submit that Claim 16 likewise is patentable over Mattson et al. in view of Snyder et al. and further in view of Toth et al. and further in view of Florent et al.

Claim 22 recites a computed tomographic (CT) imaging system for reconstructing an image of an object wherein the imaging system includes "a detector array...at least one radiation source...a computer coupled to said detector array and said radiation source, said

computer configured to...estimate a gradient for at least one high-density object...generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*...generate an error-candidate projection using the gradient image."

No combination of Mattson et al., Snyder et al., Toth et al., or Florent et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computed tomographic (CT) imaging system having a computer configured to generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value, and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Furthermore, no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computed tomographic (CT) imaging system having a computer configured to generate an error-candidate projection using the gradient image. Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, and Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image, Toth et al. describe obtaining a calibration error vector (CEV) that is representative of the circularly symmetric image error, and Florent et al. describe using a scale factor to geometrically relate a source image and a target image, but none of Mattson et al., Snyder et al., Toth et al., or Florent et al. describe an error candidate projection. Accordingly, and for at least the reasons set forth above, Claim 22 is submitted as patentable over Mattson et al. in view of Snyder et al. and further in view of Toth et al. and further in view of Florent et al.

Claim 25 depends from independent Claim 22. When the recitations of Claim 25 are considered in combination with the recitations of Claim 22, Applicants respectfully submit that Claim 25 likewise is patentable over Mattson et al. in view of Snyder et al. and further in view of Toth et al., and further in view of Florent et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 4, 16, and 25 be withdrawn.

The rejection of Claims 9 and 19 under 35 U.S.C. § 103(a) as being unpatentable over Mattson et al. (U.S. Patent No. 5,229,934) in view of Snyder et al. (U.S. Patent No. 5,078,605) and further in view of Moore et al. (U.S. Patent No. 4,222,104) is respectfully traversed.

Mattson et al. and Snyder et al. are described above. Moore et al. describe a CT scanner wherein attenuation data are determined for a plurality of sets of radiation paths through a body and a representation of the distribution of attenuation in the body is obtained using back projection that may be incorrect because of hardness error, and scattering errors. A correction can be made in a "second pass" wherein the data signals for paths through the matrix are reconstituted by forward projection by summing, for each path, the absorption values for all elements along that path and then correcting the summations to account for errors and the corrected signals are once more back projected to form a corrected representation. The procedure of forward projection, correction and back projection may be repeated to give a more accurate representation.

Applicant respectfully submits that the Section 103 rejection of the presently pending claims is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. None of Mattson et al., Snyder et al., Moore et al., considered alone or in combination, describe or suggest the claimed combination. Furthermore, in contrast to the assertion within the Office Action, Applicant respectfully submits that it would not be obvious to one skilled in the art to combine Mattson et al with Snyder et al. and Moore et al., because there is no motivation to combine the references suggested in the art. Additionally, the Examiner has not pointed to any prior art that teaches or suggests to combine the disclosures, other than Applicant's own teaching. Rather, only the conclusory statement that "[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to have generated the error image from the gradient image through the use of a parallel beam forward projection in order to provide a simple procedure for the generation of the image" suggests combining the disclosures.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicants' disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck , 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion or motivation to combine the prior art disclosures, nor any reasonable expectation of success has been shown.

Furthermore, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. Further, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection appears to be based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention.

Moreover, if art "teaches away" from a claimed invention, such a teaching supports the nonobviousness of the invention. U.S. v. Adams, 148 USPQ 479 (1966); Gillette Co. v. S.C. Johnson & Son, Inc., 16 USPQ2d 1923, 1927 (Fed. Cir. 1990). In light of this standard, it is respectfully submitted that the cited, as a whole, is not suggestive of the presently claimed invention. Moreover, Applicant submits that Mattson et al. teach away from Snyder et al., and the present invention, and as such, there is no suggestion or motivation to combine Mattson et al. with Snyder et al.. Specifically, Mattson et al. describe correcting bad data in an image wherein bad data is described as being:

> ...caused by any one of these components going bad, a loose wiring connection, or even downstream components, such as channels of an analog-to-digital converter, going bad. The bad data could take the form of a constant zero output, an intermittent

> zero or high output, noise or static superimposed on otherwise good data....

Mattson et al., column 3, lines 48-54. Snyder et al. describe a technique that differentially estimates and removes noise as a signal-dependent function of image the image features. The present describes reducing artifacts caused by a rapid change of the anatomy in the z direction and an inability of a linear interpolation to produce accurate sample estimation. Therefore Mattson et al. and Snyder et al. correct data for machine borne electrical defects, while the present invention describe a different field of error correction due to anatomy borne artifacts. Moreover, the present invention describes a gradient image that represents the variation of a high density object, for example, a rib or spine, in the *z* direction at the reconstructed image location. Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction, but neither of Mattson et al., Snyder et al., or Moore et al. describe an error candidate projection. Accordingly, for at least the reasons set forth above, Applicant respectfully requests that the Section 103 rejection be withdrawn.

Moreover, and to the extent understood, no combination of Mattson et al., Snyder et al., or Moore et al. describes or suggests the claimed combination and as such, the presently pending claims are patentably distinguishable from the cited combination. Specifically, Independent Claim 1 recites a method for facilitating reconstruction of an image wherein the method includes "estimating a gradient for at least one high-density object...generating a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*...generating an error-candidate projection using the gradient image."

None of Mattson et al., Snyder et al., or Moore et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests generating a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a one or a zero value, and Snyder et

al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Furthermore, no combination of Mattson et al., or Snyder et al., or Moore et al., alone or in combination, describes or suggests generating an error-candidate projection using the gradient image. Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image, and Moore et al. describe correcting a back projected image for hardness error and scattering errors by forward projecting the image by summing, for each path, the absorption values for all elements along that path and then correcting the summations to account for errors and the corrected signals are back projected to form a corrected representation, but none of Mattson et al., Snyder et al., or Moore et al. describe an error candidate projection.. Accordingly, and for at least the reasons set forth above, Claim 1 is submitted as patentable over Mattson et al. in view of Snyder et al and further in view of Moore et al.

Claim 9 depends from independent Claim 1. When the recitations of Claim 9 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claim 9 likewise is patentable over Mattson et al. in view of Snyder et al. and further in view of Moore et al.

Claim 13 recites a computer programmed to "estimate a gradient for at least one high-density object...generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*...generate an error-candidate projection using the gradient image."

None of Mattson et al., Snyder et al., or Moore et al. describes or suggests the claimed combination. Specifically, Applicant respectfully submits that no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computer programmed to generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*. Rather, in contrast to the present invention, Mattson et al. describe a gradient image (52) in which each pixel value has either a

one or a zero value, and Snyder et al. describe a gradient image represents the magnitude of the gradient at each point in the image, independent of direction. Furthermore, no combination of Mattson et al. and Snyder et al. alone or in combination, describes or suggests a computer programmed to generate an error-candidate projection using the gradient image. Rather, in contrast to the present invention, Mattson et al. describe forwardprojecting and backprojecting data, but Mattson et al. do not describe generating an error-candidate projection, and Snyder et al. describe a noise estimating technique that provides a signal dependent noise characterization of the image by segmenting the image into a plurality of images that each represents a certain range of code values found in the original image and Moore et al. describe correcting a back projected image for hardness error and scattering errors by forward projecting the image by summing, for each path, the absorption values for all elements along that path and then correcting the summations to account for errors and the corrected signals are back projected to form a corrected representation, but none of Mattson et al., Snyder et al., or Moore et al. describe an error candidate projection. Accordingly, and for at least the reasons set forth above, Claim 13 is submitted as patentable over Mattson et al. in view of Snyder et al. and further in view of Moore et al.

Claim 19 depends from independent Claim 13. When the recitations of Claim 19 are considered in combination with the recitations of Claim 13, Applicants respectfully submit that Claim 19 likewise is patentable over Mattson et al. in view of Snyder et al. and further in view of Moore et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 9 and 19 be withdrawn.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Favorable action is respectfully solicited.

Respectfully submitted,

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